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## Analysis of unfair means cases in computer-based examination systems



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### ABSTRACT

There are mainly two systems of examination used by educational institutes to evaluate the performance of students. Most institutes use the conventional examination system, and some use computer-based examination systems. Unfair means is an illegal act by a student in either type of examination systems. In this paper, we will provide an overview of the types of examination systems. We will discuss types of unfair means cases in computer-based examination systems and will discuss some patterns and trends discovered using data mining techniques. After discussing the patterns, we will also suggest some key points for avoiding and diminishing the unfair means cases.

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## 1. Introduction

This research is based on the Virtual University of Pakistan. Educational institutes provide the facilities for students to gain knowledge and skills. To evaluate student performance, institutes use assignments, quizzes, general discussions and examinations. There are two types of examination systems: a paper-based examination system and a computer-based examination system.

## 2. Types of examination systems

There are two types of examination systems: one is a paper-based examination system, and the second is a computer-based examination system.

### 2.1. Paper-based examination system

In the paper-based examination system, students attempt their exams on paper; answer sheets are provided to the students with the question paper. The students write the answers on the paper and submit them to the respective invigilator. The papers will be sent for grading to the respective evaluator. This examination

system is conventional and easy to conduct because it only requires some chairs in an examination hall where students can sit and complete their exams. The answer sheets are provided to the students for attempting or answering the asked questions. The examiners monitor the students to prevent unfair means cases or any misconduct.

### 2.2. Computer-based examination system

In the computer-based examination system, students attempt their exams on computers. There are two types of computer-based examination systems:

- Online examination.
- Offline examination.

#### 2.2.1. Online examination

In the online examination system, exams are conducted on the internet. Electronic files are placed on a dedicated server, from which students access the file and answer the questions. After answering the questions, the solution file is uploaded back on that server. The solution file may be uploaded after the student completes it or through an auto-save procedure that automatically saves the students' data to the server after some specific time.

Here, the following question arises: how can an institute monitor the students during the online examination? If all students complete their exams from a designated exam centre, the

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institute can appoint invigilators or a superintendent in that specific examination centre. However, because these exams are conducted on the Internet, it is possible that one can complete his/her exam from his/her home or even in his/her living room. It is not possible for an institute to arrange a specific superintendent for invigilation of all such students who attempt the exams from their living places. In this situation, students are monitored by web cams, which are placed in such a way that those cameras cover all the surroundings of the student to ensure that nobody is near the student. These web cams are monitored by invigilators checking the computer screen. The invigilator can use software that displays the student's computer screen, such as Team Viewer.

### 2.2.2. Offline examination

In the offline examination system, the question file is placed on the server of a local area network (LAN) in each exam centre (for example, if there are 10 exam centres selected for the examination, then every exam centre has its own LAN). The students access their exams from the server on the LAN and answer the questions on a computer that is connected to that specific LAN. For invigilation purposes, invigilators and superintendents perform the duties at their designated exam centres. Each student's solved file or data is saved on the server of that LAN, from which it is uploaded to a main server of the institute, where it will be available for grading. The student's solution is saved on the local server of the LAN after the completion of the paper or automatically after some specific time interval. When all the papers are completed, every exam centre uploads the solution files to the main server of the institute, where they will be available for grading.

The Virtual University of Pakistan uses both types of computer-based examination systems. The online examination system is used for its overseas students. The exam file is uploaded on the dedicated server, from which students access their exams and solve the problems; the students' answers are saved automatically on the server after some specific time period. The offline examination system is used for its more than 100 examination centres. All exam centres download their respective exam files and load them on the server of their LAN, and students access their papers from the computers that are connected to that LAN. At the end of the day, when all papers are completed, the solution files are uploaded on the exam server of the Virtual University of Pakistan.

## 3. Unfair means cases

In every type of examination, there are many students who use unfair means and seek help from other people or things during the examination. Although students use unfair means in every type of examination system, here, we discuss unfair means cases in computer-based examination systems, analyse the real data of unfair means cases that are filed in computer-based examination systems and try to identify some trends or patterns using data mining techniques.

### 3.1. Unfair means cases in computer-based examination systems

We have collected the unfair means cases (UMC) data of undergraduate students from the Virtual University of Pakistan for 13 semesters from Fall 2009 to Fall 2015. The Virtual University uses a computer-based examination system. In Virtual University UMC, cases were registered against the students, and these cases were sent to the Committee on Unfair Means (COUM). The COUM sends a show cause notice to the student, and the student replies

to that notice explaining his/her view. After a proper inquiry based on evidence provided by the superintendents and invigilators, COUM makes a decision and issues a verdict accordingly.

### 3.2. Missing values treatment

We analysed the unfair means cases and found that some values are missing in the column of verdict/decision issued by COUM. After further analysis, we observed that there are two basic types of decisions: fail in the subject or exonerate the student. We have filled in these missing values by applying some modified missing value treatment using the mean method. Using this method, we take the mean value of all the entries and fill in the missing entries with that mean value. In our data, there are only two types of verdicts; therefore, we took the average of both verdicts and filled in the missing entries accordingly.

## 4. Types of unfair means cases

There are eight main types of unfair means cases, as listed in Table 1.

If we analyse Table 1, it clearly shows that the number of male students involved in UMC cases is higher than the number of female students. The ratio of male to female students in each type of UMC is shown in Graph 1.

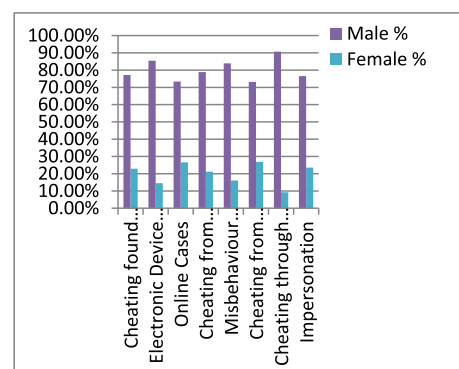
### 4.1. Cheating from helping material

Cheating by using a helping material means cheating by book, written material found on a piece of paper, notes or material written on the student's own body such as on a hand or arm. We found that in this category, most students used notes written on a piece of paper.

As we see in Table 2, the number of cases in which the verdict was failure in the subject is higher for all other case types than for cases involving notes written on the hand. The reason for this is

**Table 1**  
Types of UMC.

UMC type/category	No of cases	Male	Female
Cheating found during marking	2582	1991	591
Electronic device found during paper	778	665	113
Online cases	556	408	148
Cheating using a helping material	397	313	84
Misbehaviour cases	298	250	48
Cheating involving another student	231	169	62
Cheating through computer	205	186	19
Impersonation	34	26	8



**Graph 1.** Male-to-female ratio.

**Table 2**  
Cheating by using a helping material.

Cheating case type	No of cases	Released result	Fail in subject
Cheating through book	12	2	10
Written on hand	11	7	4
Cheating by helping material	360	75	285
Cheating through notes	14	0	14

that when a case of cheating by material written on a student's hand is registered, the superintendent faces problems providing evidence. Without sufficient evidence, COUM issues a verdict in favour of the student (Graph 2).

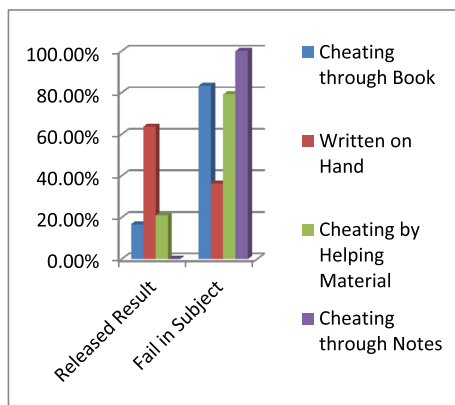
#### 4.2. Cheating through computer

In a computer-based examination system, the exam is conducted on PCs, so the computer can be used for cheating. Students can obtain help from soft notes, lectures, the Internet, and prohibited software. For example, if a student is attempting an English paper and MS WORD is not allowed, the student may use MS WORD for synonyms, spelling, grammar and word meanings. In this category, there are two basic types as listed in Table 3.

In Table 3, we observe that every student caught using soft copy notes received a verdict of failure in the subject, and most of the students in cases involving prohibited software were released. It seems that in these types of cases, the superintendent did not collect sufficient evidence (Graph 3).

#### 4.3. Electronic device found during exam

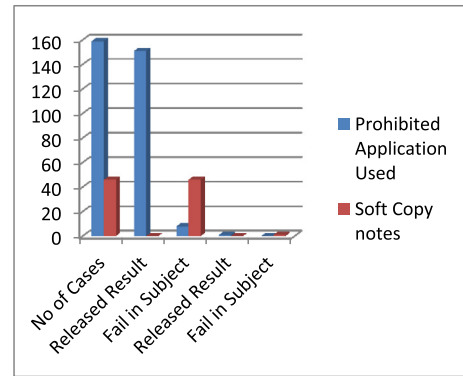
Some students use electronic devices such as mobile phones, calculators, USB and PDAs for cheating purposes. Mobile phones are used for calling during exam time, sending and receiving SMS, and carrying notes or exam-related material. The USBs are used to carry exam-related notes, lectures and books. Calculators are used in mathematical-based exams such as statistics and mathematics. Some other devices are also used for cheating such as PDAs and digital dictionaries, as listed in Table 4.



**Graph 2.** Verdicts on cheating by using a helping material.

**Table 3**  
Cheating from computer.

Case type	No of cases	Released result	Fail in subject
Prohibited application used	159	151	8
Soft copy notes	46	0	46



**Graph 3.** Verdict on cheating from computer.

**Table 4**  
Cheating from electronic devices.

Device type	No of cases	Released result	Fail in subject
Mobile phone	726	697	29
Calculator	17	17	0
USB	33	16	17
Other	2	2	0

In Table 4, we observed that most students used mobile phones, but the number of release verdicts is much higher than the number of failure verdicts. It seems that students carry their mobile phones with them during exam time but are not using them for cheating purposes (Graph 4).

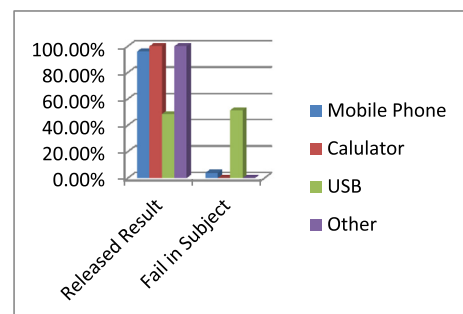
#### 5. Online cheating cases

While attempting online examinations, students use different tactics to dodge the invigilator, such as not showing their web cams according to the prescribed position, going offline or using an improper screen view. The students dim the lights so that the invigilator is unable to observe the surroundings and the students can easily cheat and use unfair means (Table 5).

We observe that most students involved in online cheating cases did not show their web cams. It may be for only one or two questions, or it may be repeatedly after some intervals. The number of failure verdicts in this category of UMC cases is higher than the number of release results (Graph 5).

#### 6. Cheating found during grading

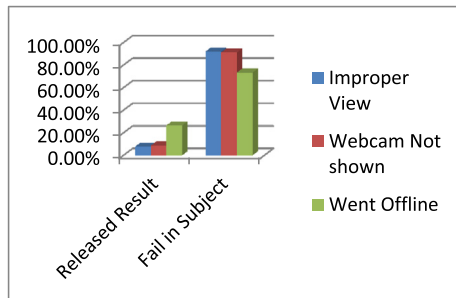
Many students involved in cheating are not caught by superintendents and invigilators. To avoid this type of cheating, answer



**Graph 4.** Verdict ratio of using electronic devices during paper.

**Table 5**  
Online cheating cases.

Online case reason	No of cases	Released result	Fail in subject
Improper view	38	3	35
Webcam not shown	503	44	459
Went offline	15	4	11



**Graph 5.** Verdict ratio in online cheating cases.

materials will be checked during the grading of papers to ensure that answers are not copied from course handouts, the Internet or any other students (Table 6).

The students in such cases will be treated as cheating, and the verdict of the COUM will be failure.

## 7. Other cheating types

Students are also involved in activities as listed in Table 7: students seek help from other students, help others or misbehave with the superintendents or invigilators, and in some cases, another person attempts the exam in the student's place. Sometimes the superintendent has a doubt that a student is actually the one taking the exam because the student ID card picture differs from the current appearance of the person taking the examination.

In Table 7, we observed that more impersonation cases received a failure verdict than a release verdict because when a student is caught red-handed, the verdict will always be failure. If the superintendent suspects any student of impersonation, then it will be verified, and sometimes the superintendent's observation may be wrong (Graph 6).

## 8. Results and facts

We have found the following facts and patterns after the detailed analysis of unfair means cases data:

**Table 6**  
Cheating found during marking.

Case type	No of cases	Released result	Fail in subject
Cheating from handout	1951	0	1951
Cheating from internet	527	0	527
Cheating from other students	104	0	104

**Table 7**  
Other types of UMC cases.

Case type	No of cases	Released result	Fail in subject
Misbehaviour cases	298	92	25
Cheating from other students	231	47	38
Impersonation cases	34	11	23



**Graph 6.** Verdict ratio in other cheating cases.

- More males are involved in UMC than females.
- Most students cheating are caught during the grading of papers.
- More cheating occurs from pieces of paper than from books, notes, etc.
- Students prefer on-the-spot cheating over planned cheating.
- Students feel ease in taking software help rather than opening a notes file or Internet from a computer.
- In online cases, most students close their web cams so that they can cheat easily.
- Most of the students use tactics so that they are not caught in the examination hall.

## 9. Future directions and working

We have analysed the UMC data of the Virtual University of Pakistan and discussed various types of unfair means cases in computer-based examination systems. In the future, one can analyse the data and find some patterns and trends of unfair means cases according to the following key points:

- Degree programme, i.e., in which study programme are the most students involved in unfair means cases.
- Newly admitted students' involvement in UMC compared with continuing students.
- Grades/CGPA distribution, i.e., which grades students involved in UMC mostly obtain.
- Course distribution, i.e., in which subject/course do the most students use unfair means.
- Semester distribution.
- Behaviour of students towards study after being found guilty in unfair means cases.

## 10. Conclusion

In this paper, we have provided an introduction to the types of examination systems, i.e., paper-based and computer-based examinations. Computer-based examination is further classified into two major categories, offline and online. In an online examination system, there must be Internet-involved data saved on a dedicated server. In an offline system, every exam centre has its own server; data are saved on that server, and at the end of the day, the data are uploaded to a dedicated server. We have analysed the UMC data of the Virtual University after missing value treatment using the mean method. Various types of UMC in computer-based examination systems have been discussed, and we found some facts and patterns. Directions for future research are also proposed at the end of the paper.

**Further reading**

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